

**CLAIMS:**

1. A rotary thermocycling apparatus, especially for biochemical reactions, comprising:

5 (a) a plurality of stations and especially at least four stations for receiving samples in a flat-bottomed container, each station having a flat heated plate on which said container is placed and having means to independently control said heated plate at a pre-determined temperature;

10 (b) means to move each said flat-bottomed container from one station to another station in a pre-determined sequence;

(c) at least two of said stations having a heating unit adapted to be lowered over a container located on said station; and

(d) at least one station having a spray unit adapted to spray a liquid reagent(s) into a container located at said one station.

15 2. The apparatus of Claim 1 in which said station of (d) is adapted for removal of a cover plate from said container prior to activation of the spray, and for replacement of the cover plate after said spray has terminated.

20 3. The apparatus of Claim 1 or Claim 2 in which the container is a flat-bottomed container of a dimension less than that of the station.

25 4. The apparatus of any one of Claims 1-3 in which the heating unit is comprised of a section with a flat lower surface that is adapted to be lowered into said container close to but not in contact with the sample in said container.

5. The apparatus of Claim 4 in which said lower surface of the heating unit is lowered into contact with a cover plate therein.

30 6. The apparatus of any one of Claims 1-5 in which the apparatus

has a programmer for controlling at least (i) the temperature at each station, (ii) the dwell time in each station, (iii) the duration and timing of the spray(s), and (iv) the number of sequential cycles for the biochemical reaction.

5           7.       The apparatus of any one of Claims 1-6 in which the container is adapted to receive a filter having the sample thereon, and to receive a cover plate over said filter.

10           8.       The apparatus of any one of Claims 1-7 in which the apparatus is programmable and automated.

15           9.       The apparatus of any one of Claims 1-8 in which the apparatus is adapted to process more than one sample at a time, up to one for each station in the apparatus.

20           10.      The apparatus of any one of Claims 1-9 in which there is an automatic loader for placing containers into the apparatus and for removing containers therefrom.

25           11.      The apparatus of any one of Claims 1-10 in which the heating units are on pistons that are lowered into the containers.

30           12.      The apparatus of any one of Claims 1-11 in which the station with the spray unit is followed in sequence by the two stations having heating units.

13.       A method for a sequential reaction especially a sequential biochemical reaction at different temperatures, comprising:

- 30           (a)     placing a sample in a flat-bottomed container;
- (b)     sequentially cycling said sample through predetermined changes in temperature by placing said flat-bottomed container on flat heated

plates at each said temperature for a predetermined period of time;

(c) optionally spraying said sample with at least one liquid reagent;

(d) controlling at least (i) the temperature at each station, (ii) the dwell time in each station, (iii) the duration and timing of the spray(s), and (iv) the number of sequential cycles for the biochemical reaction.

14. The method of Claim 13 in which the biochemical sample is located on a filter, a membrane, a microtitre container or microscope slide in said container.

15. The method of Claim 13 or Claim 14 in which the method is programmable and automated.

16. The method of any one of Claims 13-15 in which the sample is subjected to a pre-treatment prior to the method for the sequential reaction.

17. The method of any one of Claims 13-16 in which a spacer is placed on the filter and a cover plate is placed on the spacer.

18. The method of any one of Claims 13-17 in which the reaction is a polymerase chain reaction.

19. The method of any one of Claims 13-17 in which the reaction is for detection of specific DNA sequences.

20. The method of any one of Claims 13-17 in which the reaction is for detection of bacteria.

21. The method of any one of Claims 13-17 in which the reaction is for enumeration of a distinct type of bacterium or species.

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22. The method of any one of Claims 13-21 in which the sample is subsequently subjected to a photochemical detection process to detect product of the reaction.

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23. The method of Claim 22 in which the photochemical detection process comprises fluorescence.

24. The method of Claim 22 or Claim 23 in which there is electronic recording thereof.

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25. The method of Claim 24 in which the electronic recording comprises using a video camera.

26. A rotary thermocycling apparatus especially for biochemical reactions, comprising:

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(a) a plurality of stations for heating biochemical samples in a flat-bottomed container at predetermined temperatures;

(b) means to move each said flat-bottomed container from one station to another station in a pre-determined sequence; and

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(c) at least one station having a spray unit adapted to spray liquid reagent(s) into a container located at said one station.

27. A method for a sequential biochemical reaction at different temperatures, comprising placing a biochemical sample in a container and sequentially cycling said biochemical sample through predetermined changes in temperature by heating said container on a sequence of flat heated plates for a predetermined period of time.

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28. A method for a sequential biochemical reaction at different temperatures, comprising placing a biochemical sample on a filter or

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membrane and sequentially cycling said biochemical sample through predetermined changes in temperature, at least one step in the sequence involving spraying the sample with at least one liquid reagent.

- 5            29.    The method of Claim 28 in which the sample is on a filter having an underpad of absorbed salts.

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